

Climate change: be part of the solution

Focus on: farm anaerobic digestion

WHAT IS ANAEROBIC DIGESTION?

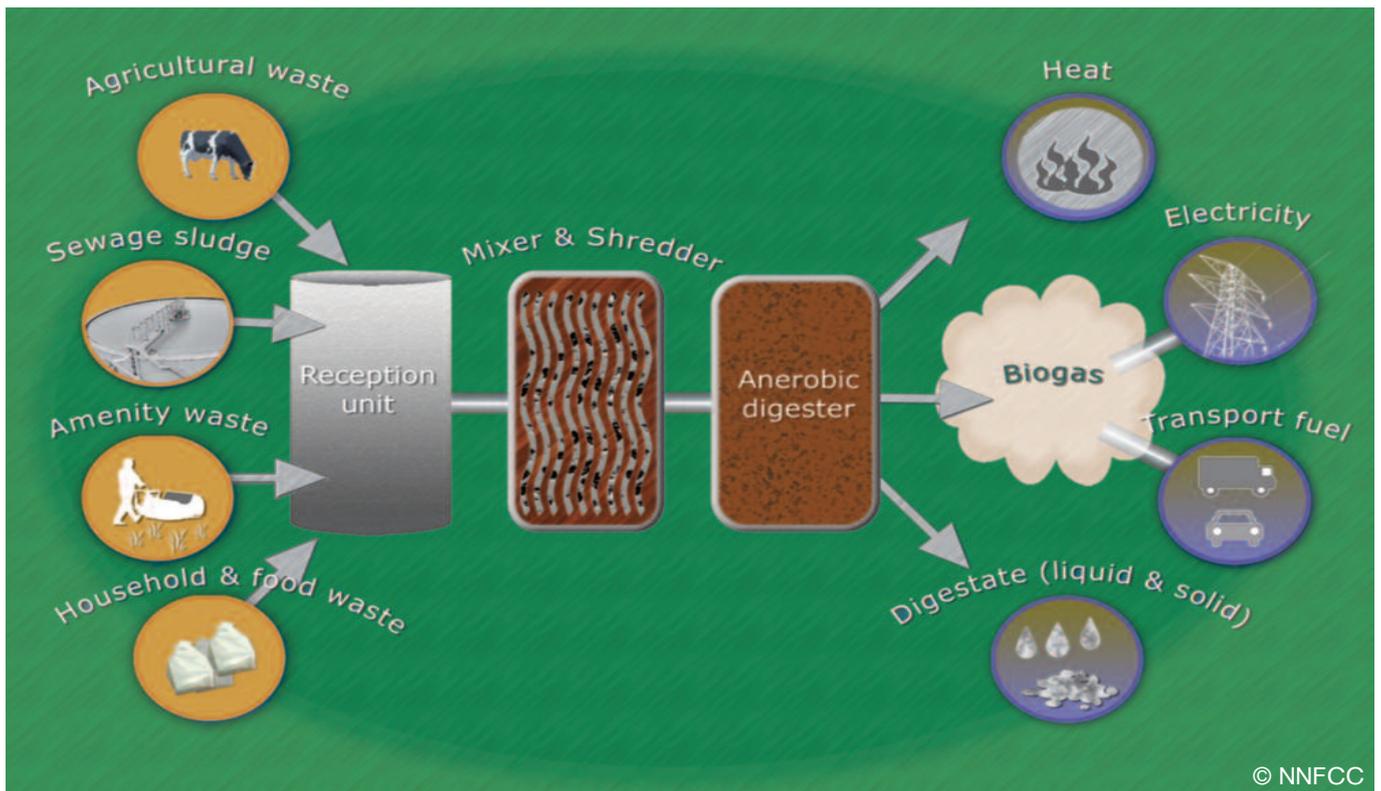
Anaerobic digestion, popularly known as ‘AD’, is the controlled break down of organic matter in the absence of air to produce a combustible biogas and nutrient rich organic by-product. AD systems can be located either on-farm or at a larger Centralised Anaerobic Digestion management facility (CAD plant). AD technology can have multiple benefits: increasing farm business profit; helping to mitigate climate change; and helping to manage manures, slurries and waste.

HOW DOES IT WORK?

Organic material (feedstock) is collected and stored in a closed, airless container that acts as the ‘digester’. During 20 – 40 days (depending on the internal temperature of the digester), bacteria break down the feedstock, creating biogas. The biogas can be combusted to generate heat or electricity (or both), and in some circumstances can be cleaned and pressurised for use as a vehicle fuel or put into the gas grid. The other product (digestate) is a valuable nutrient source and soil conditioner, in which the nutrient nitrogen is more readily available than in raw manures.

WHAT SORT OF ORGANIC MATTER CAN BE USED AS A FEEDSTOCK?

The feedstock is the biodegradable plant (non-woody), animal or waste material that is digested to produce the biogas. The Environment Agency and WRAP have produced a Quality Protocol listing the materials that can be used as feedstocks. Some of those include: animal manures and slurries, energy crops such as whole-crop (silage) maize or grass leys, crop co-products (such as brewers and grains), food by-products and pack house residues, animal by-products (abattoir waste), biodegradable domestic waste, and sewage sludge.





TYPES OF OPERATION

- On-farm – There are broadly two different business models for AD. The simplest and lower cost model involves feedstocks that are farm based, such as manures, slurries, and silage, and possibly co-products such as brewer's grains. These operations are suitable for most farms.
- CAD – The alternative is a centralised plant that uses wastes that currently attract a gate fee, but involves higher project and management costs than an on-farm plant. Digestion of food and other commercial wastes (by displacing landfill) offers the added benefit of greater greenhouse gas savings than digestion of manure or energy crop feedstocks alone.

WHAT IS PRODUCED?

- Biogas – a mixture of methane, carbon dioxide (approximately 60:40 ratio) and traces of other gases. This can be burned to produce electricity and heat, known as Combined Heat and Power or CHP. There is increasing interest in cleaned and pressurised biogas for use as vehicle fuel or a renewable replacement for (fossil based) natural gas or LPG.
- Digestate – a low odour, slow release, pathogen reduced substance that can be applied directly to land or separated into a liquid nitrogen fertilising material and a fibrous phosphate soil conditioner.

HOW MUCH DOES AN AD PLANT COST?

Capital costs and fixed operating costs are sensitive to scale:

- A small 15kW plant fed by 150 cows might cost about £150,000, but may not be economically viable without significant financial support.

- A 250kW farm-scale digester processing manures from a herd of 500 and supplemented with silage energy crops would cost £0.75-1 million, possibly earning energy revenues of £200-300,000.
- A larger centralised plant of 1MW capacity, using a mixture of feedstocks (manures, silage and imported waste) would cost £3-4 million but could earn energy and gate fee revenues in excess of £1 million/year.

Most plants in planning in the UK are between 500kW and 1MW capacity, as this scale of plant is the most economically viable in the present climate.

HOW CAN AD BE A PART OF THE CLIMATE CHANGE SOLUTION?

- Emissions of methane (a greenhouse gas which is 23 times more potent than carbon dioxide) from the decomposing feedstock are captured within the digester, rather than released into the atmosphere as from conventional manure storage systems, landfill sites or badly managed compost sites.
- The captured methane can be used instead of conventional energy generated from fossil fuels, reducing emissions of carbon dioxide.
- If digestate is used efficiently and replaces manufactured nitrogen fertiliser, it can have some effect on reducing greenhouse gas emissions associated with the production of manufactured fertiliser. At least one farmer with an AD plant has entirely replaced bought manufactured fertiliser with digestate.

WHAT ARE THE OPPORTUNITIES?

- Potential to power and heat the farm and other buildings (or sell renewable heat to local off-farm customers) and/or sell electricity to the Grid.
- Income from electricity sales from double Renewable Obligation Certificates (ROCs).
- Income from the Renewable Feed-In Tariff (FIT) from April 2010, for systems below 5MW in capacity. The current proposed tariff is 9p/kWh for electricity only and 11.5p/kWh for CHP, but higher tariffs may be introduced for smaller-scale AD systems. These prices will be guaranteed to generators for 20 years.
- The proposed Renewable Heat Incentive (due in April 2011) will also improve the financial viability of biogas heating and CHP systems.

- Reductions in methane and carbon dioxide emissions (from the better management of manure) will reduce the farm's environmental footprint and provide a point of product differentiation.
 - Potential to transform manures and slurries into a material with known nutrient properties that is easier to spread and handle, therefore matching nutrient requirements more accurately.
 - Potential to save money (and reduce greenhouse gas emissions) by replacing some of the farm's manufactured fertiliser requirement with digestate.
 - Digestate meeting the 'anaerobic digestion quality protocol' (QP) will be classified as a fertiliser product rather than a waste.
 - Potential income as a local waste processor (subject to the required permits) means gate fees generated can add another revenue stream, improving commercial viability.
 - Local farmers working as a group to develop a plant jointly can benefit from shared set-up costs and a wider supply of feedstock, enabling more advanced technology, better gas yields and therefore better returns on investment.
- WHAT ARE THE RISKS?**
- Initial set up costs are currently high, but double ROCs and FITs will help ease this, and grant aid may be available from a number of local and regional sources e.g. RDPE funding from your Regional Development Agency.
 - Potential lack of regular supply of organic material to use in digester. Securing supply contracts for feedstock is central to ensuring the generation capacity of the digester is met and therefore guaranteeing your payback period on investment. It is worth recognising that as food waste becomes an increasingly valuable resource, feedstock supply contracts for CAD facilities will become more competitive.
 - Badly managed plants may leak "fugitive emissions" which reduce the greenhouse gas savings available, but research shows that these are very low in most cases.
 - Logistics and economics of transport limit the market potential of digestate beyond its local production area.
 - Connecting electrical generating plants to the Grid can be complex and expensive.
 - Current heat prices are low but the Renewable Heat Incentive, due in April 2011 will help improve the viability of biogas technology.
 - Lack of understanding and awareness amongst planners, financiers and the general public may lead to local resistance to the new infrastructure.
 - Digestate is a rich source of nutrients. Badly managed plants and ignoring best practice guidelines when applying digestate to land risks diffuse water pollution and financial losses.



WHAT RESPONSIBILITIES DOES AD BRING?

- Environmental permits are needed in most cases.
- Developers/operators will need to secure the necessary planning permissions.
- If animal by-products are used, (e.g. meat food waste) you will need to comply with the animal by-products regulations.
- Digestate should be applied to land in accordance with best practice guidelines (nutrient management planning, soil testing) and environmental permits, in order to reduce risks of diffuse nutrient pollution and habitat damage.

GET INVOLVED WITH AD!

The UK Government has committed to reducing emissions by 80% by 2050, and in its Low Carbon Transition Plan it has for the first time set a formal framework for reducing emissions from farming. The plan recognizes the important role of AD technology in achieving emissions reductions in the farming sector.

Currently there are only a small number of on-farm AD plants in England compared to other EU countries. With over 100 million tonnes of organic material suitable for AD produced in the UK, 30% of the food that we eat ending up in the bin and a string of economic incentives on the horizon, now is a great time to be thinking about investment.

- Visit the new AD information portal set up by DECC and Defra and hosted by the NNFCC. This is a one-stop-shop for all your information about AD.
- Visit one of the five projects in England awarded grants under the £10 million Defra Anaerobic Digestion Demonstration Programme.
- Work out how feasible an AD scheme is for your business using either the NNFCC's (detailed) or the Anaerobic Digestion and Biogas Association's (simple) AD calculator.



- See the Farming Futures case studies section on how other farmers are already using AD on their farms.
- See Farming Futures event section to see a series of presentations made at our Biogas Master class workshop in June 2009.
- Rural Development Programme for England (RDPE) – contact your regional team and find out about grants available for renewable energy projects.
- Look at Renewables East's guidance notes, reports and studies into AD.
- Contact your local council to discuss waste management options.
- Purchase the CLA biogas handbook (ring 0207 235 0511).
- Log on to the International Energy Agency biogas web site to see what other countries are doing in the world of AD. www.iea-biogas.net.
- Contact the Farming Futures team and share your story.

FARMING FUTURES

For news, events, and links to stories about how other farmers are managing climate change on their farms, please visit: www.farmingfutures.org.uk

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